

U H E R O

Energy & Greenhouse Gas Solutions

Hawai'i Greenhouse Gas Profile

1990 to 2005

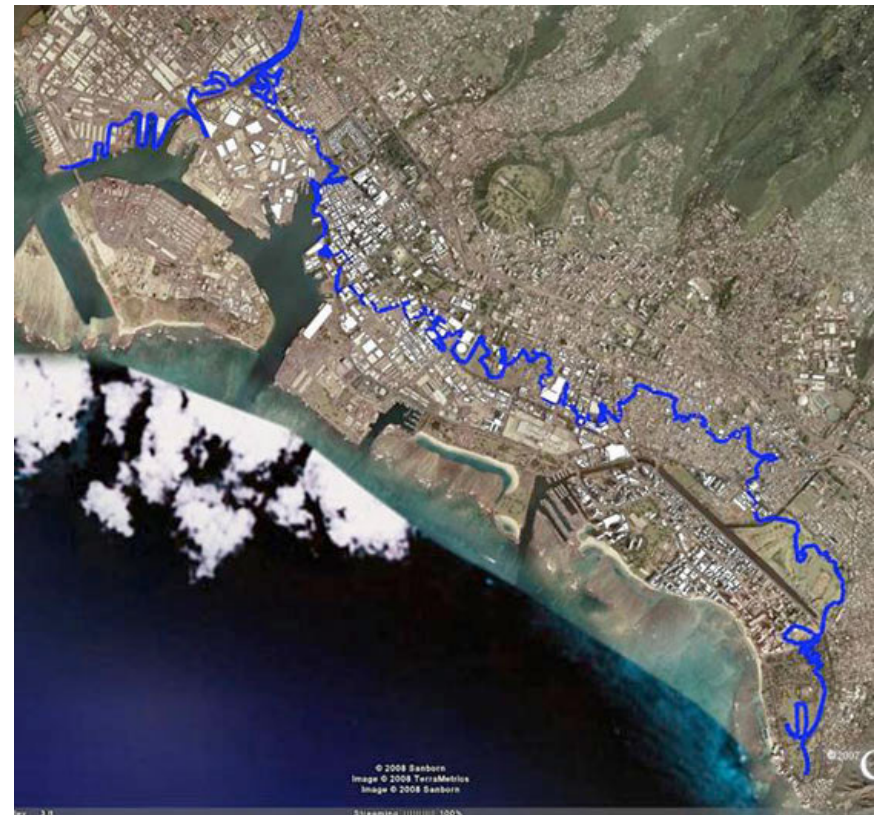
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**Presentation to Hawai'i Energy Policy Forum
December 17, 2008**



**University of
Hawai'i
Economic
Research
Organization**

- ***Energy and Greenhouse Gas Solutions*** -- economic solutions to climate change in Hawaii
- www.uhero.hawaii.edu/eggs



Source: Dr. Chip Fletcher, SOEST

Presentation Overview

- Review Hawai'i Greenhouse Gas (GHG) Legislation
- GHG regulation in other U.S. States
- Profile greenhouse gas emissions trends in Hawai'i and provide projections for anticipated future emissions
- Focus: Ground transportation

Hawai'i Climate Change Solutions: Act 234

- Caps State GHG Emissions to 1990 by 2020
- Motivation
 - Islands are likely to be disproportionately adversely affected
 - Hawai'i is 0.3% of U.S. GHG Emissions
 - » Not in Spite of ... Because of
 - » Leadership role in the U.S. & Pacific
 - Emphasis on market-based mechanisms and to minimize “leakage”
 - A mechanism to make the goals of the Hawai'i Clean Energy Initiative a reality



Over half of U.S. States are now
participating in binding GHG
reduction strategies

Regional Greenhouse Gas Initiative (ReGGIe)

- Launched in 2005
 - Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, Vermont, Rhode Island, Massachusetts, & Maryland
- Goal: 2005 levels by 2018
 - CO₂ only
 - Electric Sector only
- Cap – and – Trade
 - Primarily auction
- First auction September 2008
 - 12.5M allowances sold for \$3.07 each

Western Climate Initiative

- Launched in 2007
- Goal: 15% below 2005 by 2020
 - All sources, all major GHGs
- Arizona, California, New Mexico, Oregon, Washington, Utah, British Columbia, Manitoba & Montana
- Cap – and – trade TBD

Midwestern GHG Reduction Accord

- Launched in 2007
 - Illinois, Iowa, Kansas, Michigan, Minnesota, Wisconsin (observers include Indiana Ohio, South Dakota and Ontario)
- Very early stages: no cap or timeline has been set
- Role of agricultural offset projects are important

President-Elect Obama's Proposal

- Similar to California's AB32
- Goal 1990 levels by 2020 and 80% below 1990 by 2050
 - All sources and all major GHGs
- Upstream national cap-and-trade program

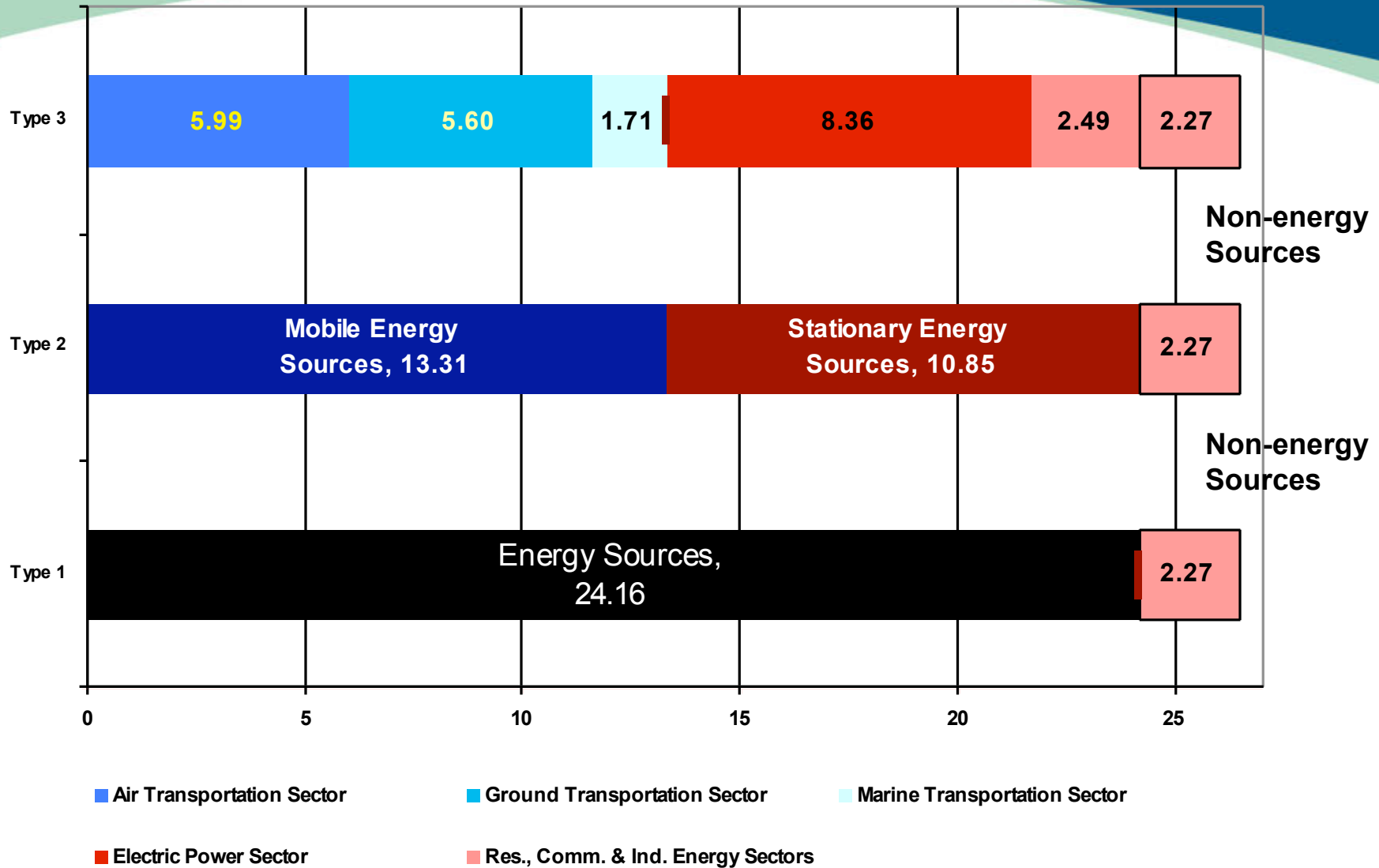
Summary

- Cap-and-trade mechanisms are being (will be) used more often than carbon tax
- Cap-and-trade mechanisms are moving towards auctioning of emissions allowances
- Baselines are being set around the years 1990 (Kyoto precedent) and/or 2005 (more recent year to obtain data)
- Targeting of specific sectors varies - although most encompass both electricity and transportation
- Emphasis on upstream regulation
- Market-based mechanisms mixed with and used to support command and control mechanisms

Greenhouse Gas Emissions (MMT CO₂E)

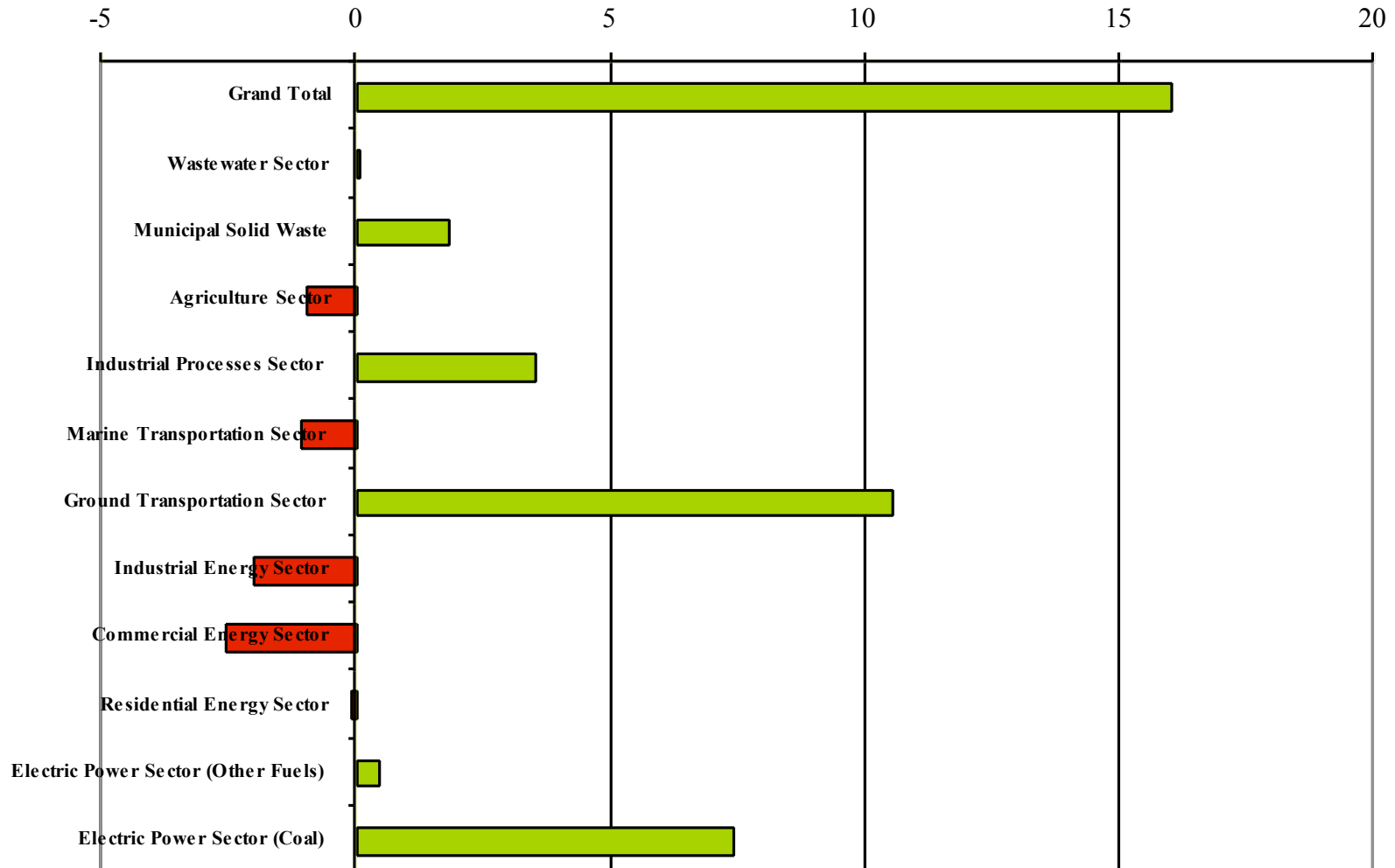
Amount of GHG Emission (MMT CO ₂ E)	1990	2005
Energy	23.232	24.161
Stationary Energy Sources	10.163	10.854
Electric Power Sector	6.804	8.362
Residential Energy Sector	0.350	0.330
Commercial Energy Sector	0.762	0.287
Industrial Energy Sector	2.246	1.874
Mobile Energy Sources	13.069	13.307
Air Transportation Sector	7.487	5.991
Ground Transportation Sector	3.666	5.601
Marine Transportation Sector	1.916	1.715
Non-Energy Sources	1.456	2.269
Industrial Processes Sector	0.197	0.844
Agriculture Sector	0.634	0.453
Waste	0.625	0.972
Municipal Solid Waste	0.506	0.838
Wastewater Sector	0.119	0.134
Grand Total	24.687	26.430

Disaggregating 2005 Emissions



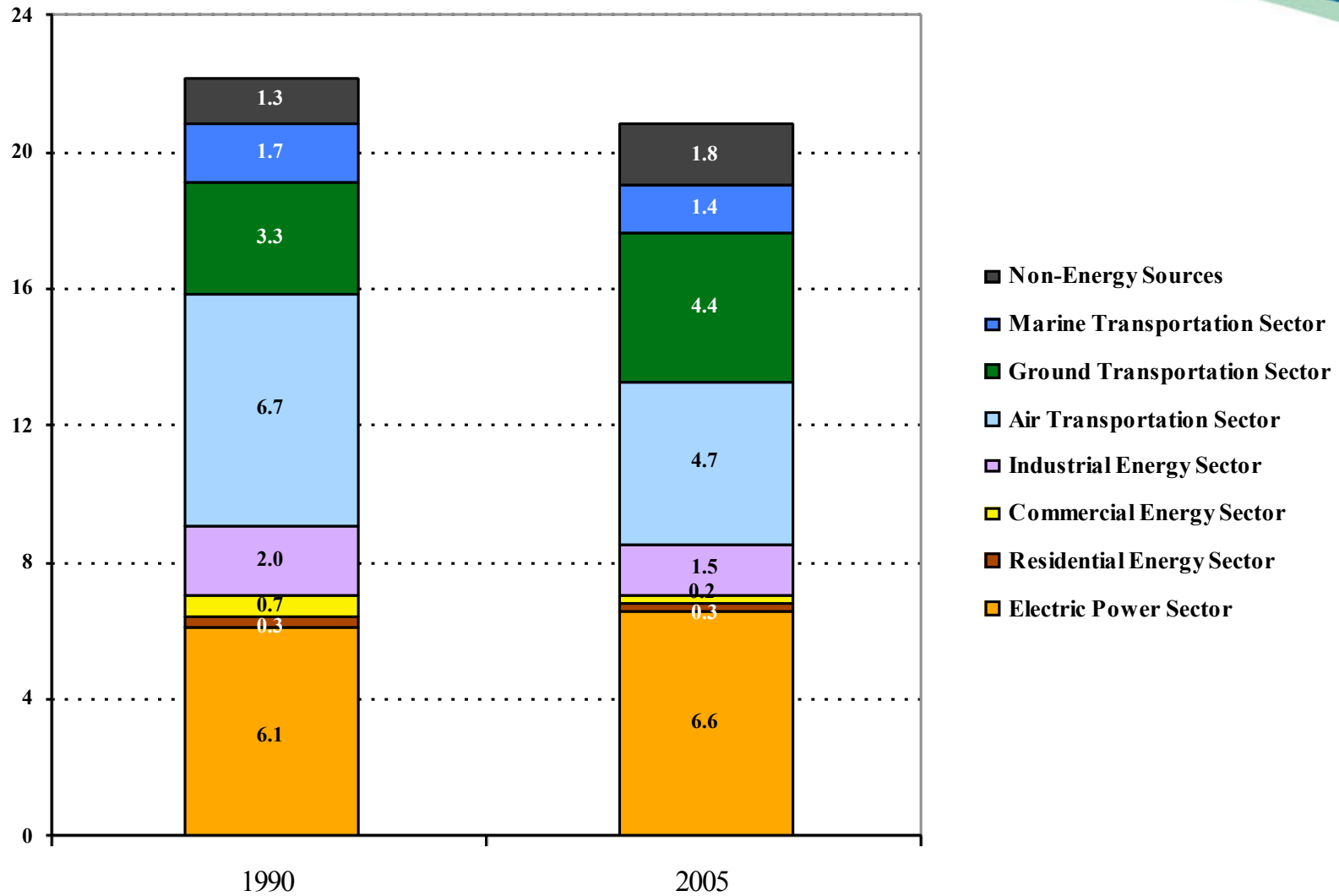
Normalized Rate of Change in Emissions (%) – No AIR

Normalized Rate of Change 1990 to 2005 (%)
(with respect to total amount of emissions in 1990)



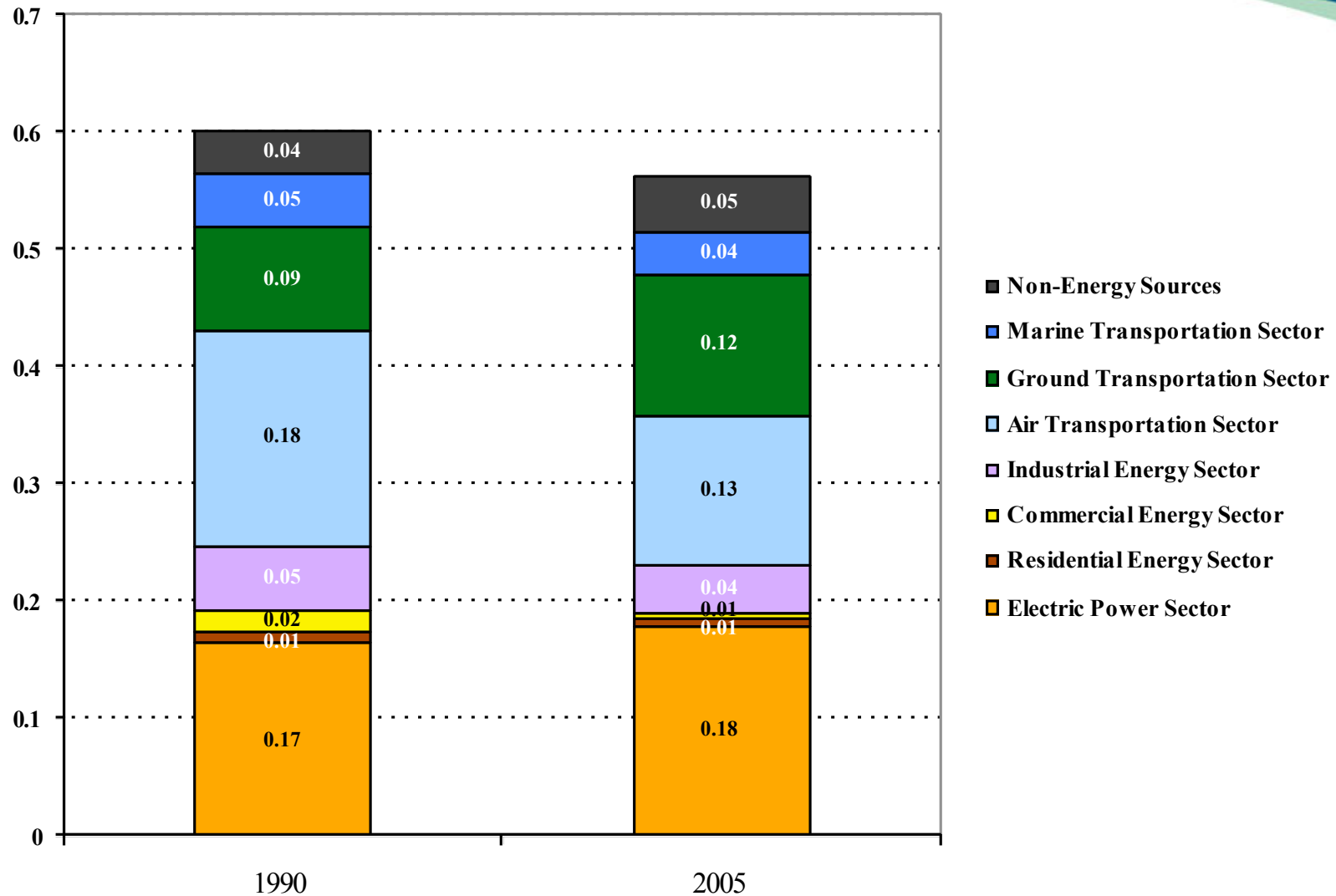
Greenhouse Gas Emissions (MT CO2E Per Capita)

MTCO2E per Capita



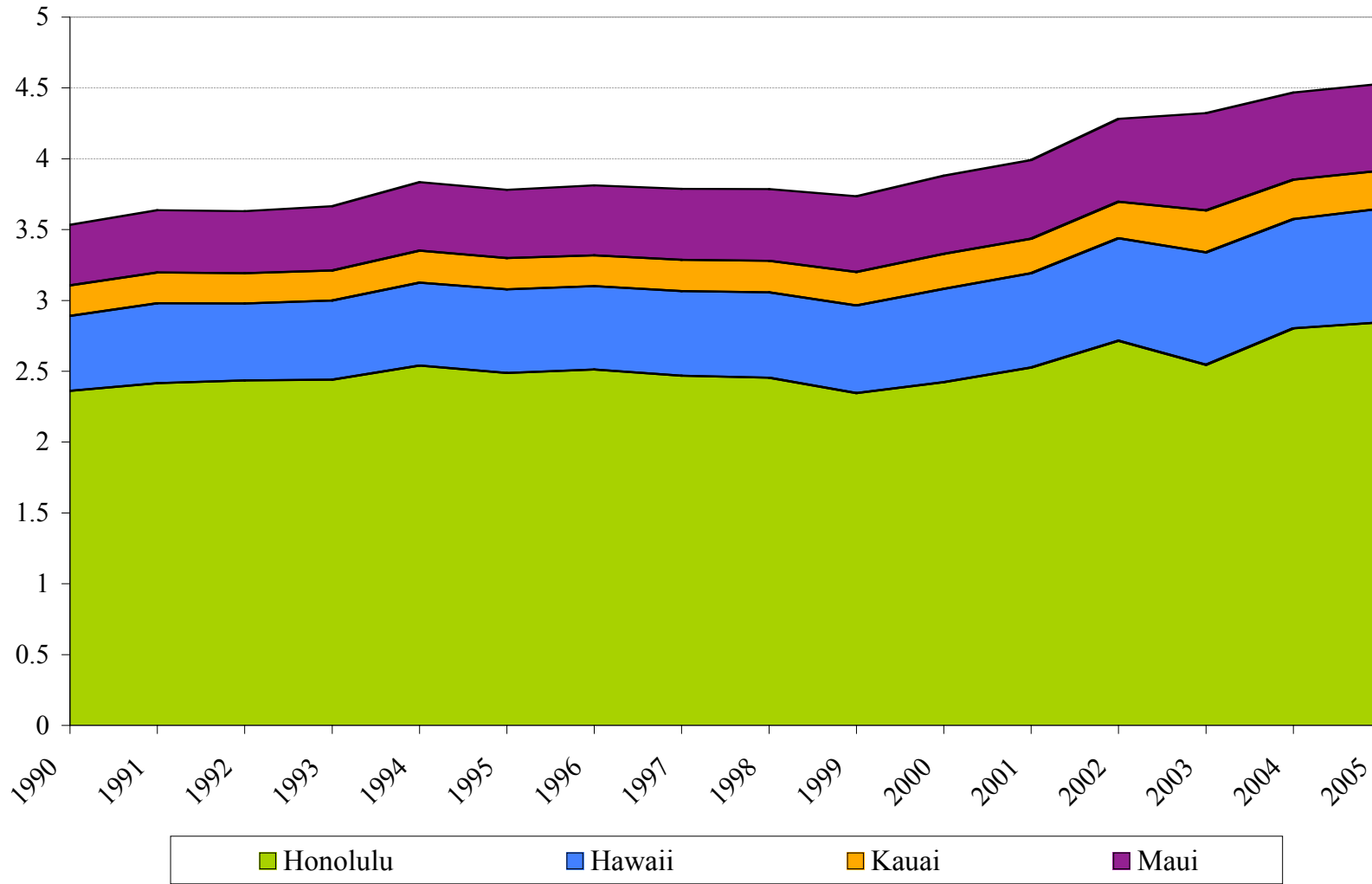
Greenhouse Gas Emissions (Per GSP)

KgCO₂E per \$ GSP

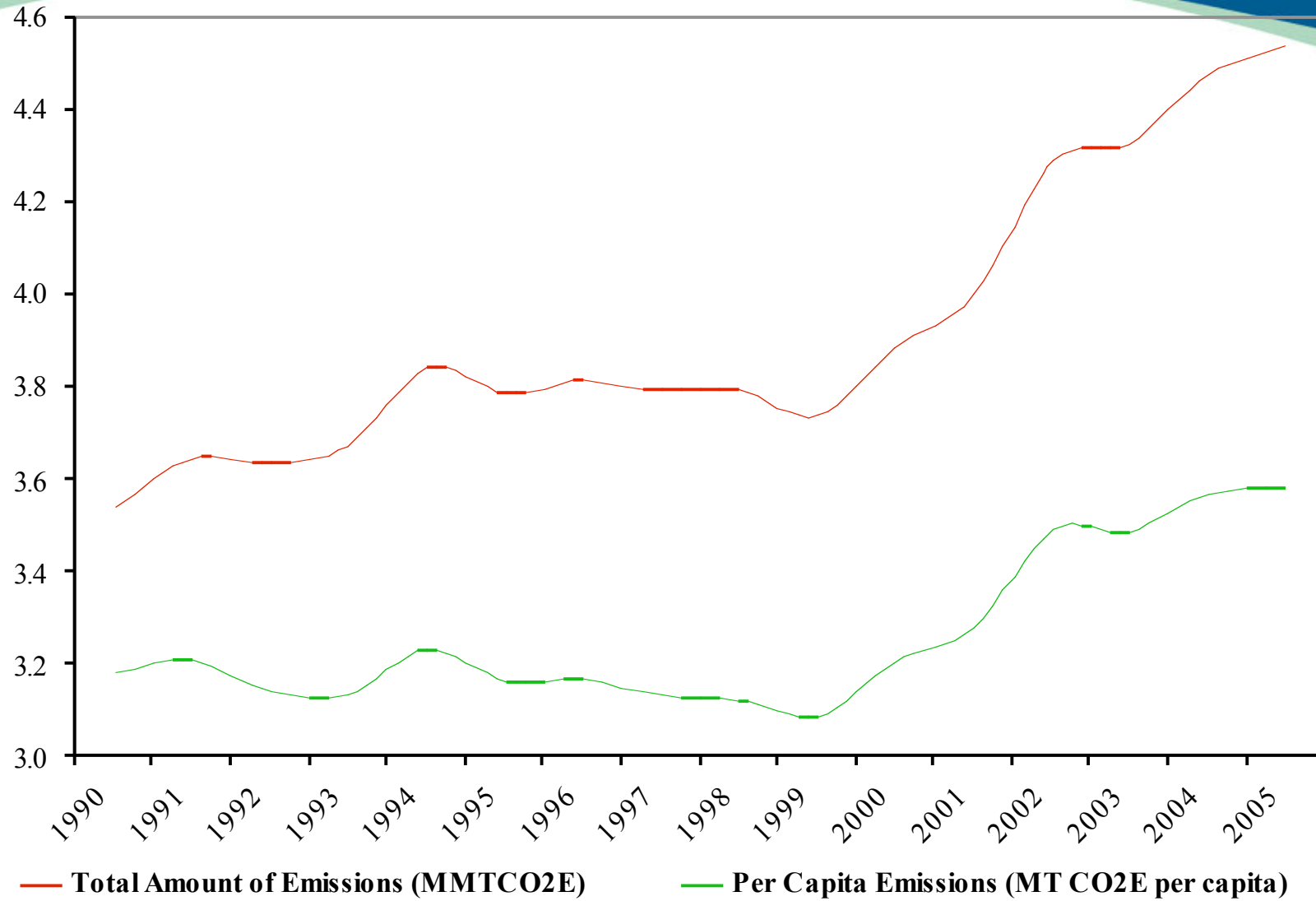


Ground Transportation Total By County

MMTCO2E



Ground Transportation GHG Emissions (Tot. , Per Cap.)



GHG Intensity per \$m (kg CO2E)

Electricity	5,894,339	Automobile rental	208,948
Synthetic gas	5,844,185	Parking lots	193,570
Air transportation	1,861,079	Petroleum manufacturing	172,038
Commercial fishing	1,656,366	Crops	170,758
Sightseeing transport	455,134	Animal	165,566
Transit	437,018	Health services	161,134
Ground transportation	407,576	Travel reservations	156,304
Laundry	390,717	Chemical manufacturing	155,664
Recreation	338,407	Other manufacturing	152,709
Hotels	311,373	Clothing manufacturing	139,771
Golf courses	301,890	Construction and mining	122,648
Other services	289,835	Education private	114,282
Waste management	281,875	Retail trade	92,672
Trucking	269,215	Wholesale trade	83,255
Restaurants	262,406	Information	78,835
Water transportation	258,510	Real estate rental	72,079
Water sewer	253,681	Landscaping services	70,777
Amusement	227,279	Finance, professional	68,869
Food processing	218,676	Performing arts	58,830

Resident and Visitor Energy and GHG Emissions

	Carbon Dioxide (tons)	Methane (tons co2e)	Nitrous Oxide (tons co2e)	Total GHG (tons co2e)
Resident	8,665,103	4,792	57,056	8,726,951
Visitor	5,008,910	3,806	34,972	5,047,687
Visitor less air	2,117,467	1,572	34,237	2,153,275
Gross state product	22,273,055	13,436	118,336	22,404,828
Per avg resident	7.16	0	0.05	7.22
Per avg visitor (year)	31.87	0.02	0.22	32.12
Per avg visitor (year) less air	13.47	0.01	0.22	13.7
Per capita	18.41	0.01	0.1	18.52
Visitor factor	4.45	6.11	4.72	4.45
Visitor factor less air	1.88	2.52	4.62	1.9

EIA Emissions Data for Hawaii

	(Million Metric Tons CO ₂)				Reduction to Return to 1990	
	History		UHERO	EIA	UHERO	EIA
	1990	2005	2020	2020	(%)	(%)
Sectors						
Com. + Ind. + Res.	0.8	0.9	1.0	1.1	18%	26%
Transportation	13.5	13.5	15.1	17.8	11%	24%
Air	8.0	5.9	8.0	9.1	0%	12%
Ground-LDV	3.0	4.5	4.1	5.3	26%	44%
Ground-Other	0.6	1.0	1.0	1.1	43%	48%
Marine	1.9	2.0	2.1	2.3	9%	17%
Electric Power	7.5	8.8	7.8	8.7	4%	14%
Total w/o Air	13.8	17.3	16.0	18.5	13%	25%
Total	21.8	23.2	23.9	27.6	9%	21%

UHERO forecast assumes 1.6% growth/yr.

EIA forecast assumes 2.5% growth/yr.

Forecasts assume national CAFE of 35 mpg by 2020, electricity sector achieves 20% RPS in 2020, and air transport efficiency improves

Implications of Emissions Forecasts and Profile

- To return emissions to 1990 levels need to address emissions from transportation and electricity which account for 95% of state's emissions
- Ground transportation experiences highest growth rate
- What would emissions be if emissions from ground transportation were cut by 20% and the electricity sector converted 1/3 of its oil-fired generation to biofuels?

EIA Emissions Data for Hawaii

	(Million Metric Tons CO ₂)				
	History	Reference Forecast		Improved Ele, Red VMT, Improved Air	
			UHERO	EIA	UHERO
	1990	2020	2020	2020	2020
By Sectors					
Com. + Ind. + Res.	0.8	1.0	1.1	1.0	1.1
Transportation	13.5	15.1	17.8	12.7	14.9
Air	8.0	8.0	9.1	6.3	7.2
Ground-LDV	3.0	4.1	5.3	3.3	4.3
Ground-Other	0.6	1.0	1.1	1.0	1.1
Marine	1.9	2.1	2.3	2.1	2.3
Electric Power	7.5	7.8	8.7	5.7	6.3
Total w/o Air	13.8	16.0	18.5	13.1	15.1
Total	21.8	23.9	27.6	19.4	22.3

20% reduction in LDVs and 1/3 conversion of oil-fired generation results in compliance with Act 234 under UHERO forecast, but more reductions needed under EIA growth forecast.

Future stages

- Hawai'i Economic – Energy – GHG Model
 - Put a price on Carbon
- Biofuels: Imported and locally grown
- Ground transportation

